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47. A Rock system anti-reflection coating wherein the second and fourth layers are substantially composed of material selected from the group consisting of tin oxide, indium oxide, zinc oxide, tin-doped oxide, tin-bismuth oxide and tin-zinc oxide, and wherein the first layer is substantially composed of silicon dioxide.

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48. The process of claim 8 wherein the act of depositing at least one other anti-reflection coating layer comprises depositing the layer between the at least two layers.

REMARKS

A. Office Action Dated March 19, 1998

In the Office Action of March 19, 1998, claims 9-10, 19-22, and 31-32 were allowed over the references of record.

Claims 24-30 were objected to under 37 CFR 1.75(c) as being of improper dependent form. It appears that this objection applies to claim 23 as well since it is in the same form.

Claims 1-4, 6, 8, 11-14, 16, 18, 23-26, 28 and 30 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,091,244; claims 5, 15 and 27 were rejected under 35 U.S.C. 103 as being unpatentable over U.S. Patent No. 5,091,244 in view of U.S. Patent No. 5,362,552; and claims 7, 17 and 29 were rejected under 35 U.S.C. 103 as being unpatentable over U.S. Patent No. 5,091,244 in view of U.S. Patent No. 5,372,874.

B. Amendments to the Specification

The specification has been amended to reinsert all references to "DC reactive" sputtering (other than references in the claims) that were deleted from the '162 patent when the reissue application was filed. No new subject matter has been added by these amendments since they merely restore the specification to the form in which it was originally filed. Restoration of this subject matter to the specification does not affect the basis for this reissue application since the declaration accompanying the reissue application continues to be accurate and to fully support a basis for reissue at the time of filing.

C. Amendments to the Claims

Claims 23-30 which were objected to under 37 CFR 1.75(c) have been canceled without prejudice to the subject matter therein. Claims 6 and 16 whose subject matter has been incorporated into their respective independent claims have also been canceled without prejudice to the subject matter therein.

The remaining claims in the application as filed (other than those allowed) have been amended and new claims 33-48 have been added. The amended claims and the new claims have been carefully drafted in view of the Examiner's comments in the Office Action of March 19, 1998 and previous examinations, and in view of the references of record in this case as well as new references cited in the accompanying Information Disclosure Statement. These claims are considered to be distinguishable from all of these references and their reconsideration and allowance is respectfully requested in view of the comments set forth below.

D. Summary of Examination to Date

The instant disclosure and various claims to the present invention have been examined during (1) the prosecution of the '162 patent, (2) the prosecution of a PCT application corresponding to the '162 patent, and (3) the present reissue application. In these three proceedings, the Examiner has, at one time or another, rejected various claims to the present invention in light of U.S. Patent No. 5,362,552 to Austin (the "'552 patent"), U.S. Patent No. 5,372,874 to Dickey (the "'874 patent"), U.S. Patent No. 5,105,310 to Dickey (the "'310 patent"), U.S. Patent No. 5,091,244 to Bjornard (the "'244 patent"), or combinations thereof. In the above proceedings, the Examiner has also considered other patents issued to these inventors, including U.S. Patent No. 5,147,125 to Austin (the "'125 patent"), U.S. Patent No. 5,270,858 to Dickey (the "'858 patent"), and U.S. Patent No. 5,407,733 to Bjornard (the "'733 patent"). Distinctions between these references as well as newly cited references will be set forth in the following discussion.

E. The Present Invention

As noted in the '162 patent application, prior art anti-reflection coatings applied to a substrate may comprise alternating layers of low and high index of refraction materials and various other combinations. This field of art is extremely crowded. This is to be expected since a change of the material, thickness, refractive index, or position of a single layer in a combination of layers can result in a coating of dramatically different properties and performance. Anti-reflection systems exist for various applications. Some are discussed in detail in the Background of the Invention section of the present application, while others are disclosed in the cited

references. In many of the prior art systems, the high refractive index hard metal oxides such as titanium dioxide or tantalum dioxide are preferred as the high index of refraction materials. See generally the '162 patent at col. 3. These hard metal oxide anti-reflection coatings are preferred because they provide excellent anti-reflection performance characteristics capable of reducing the reflectance to about 0.10% or lower. However, because sputtering of these hard metal oxides onto a substrate is relatively slow and generates significant heat, they are not suitable for temperature-sensitive substrates such as plastics which have melting points below that of glass.

The inventors of the '162 patent, however, have recognized that certain soft metal oxides having certain refractive indices may be sputtered onto temperature sensitive substrates relatively more quickly than hard metal oxides, thus resulting in the generation of less heat and making these soft metal oxides more suitable for sputter deposition onto temperature-sensitive substrates. Further, these soft metal oxides are substantially transparent and thus facilitate the formation of clear or substantially transparent anti-reflection coatings. Still further, the inventors of the '162 patent have found that certain substantially transparent anti-reflection coatings with layers comprised of these soft metal oxides have performance characteristics comparable to prior art hard metal oxide anti-reflection coatings. As discussed below, none of the references specifically applied or considered by the Examiner or of record in this case teach this novel aspect of the present invention.

F. Distinction From The References Generally

The '552 and '125 patents to Austin and the '310 and '858 patents to Dickey fail to disclose a substrate other than glass. All of the claims in the present application require substrates

other than glass, (i.e. a temperature sensitive substrate having a melting point lower than glass or a plastic or substantially plastic substrate).

While the '874 patent discloses that the substrate for its particular coating combination using niobium oxide may be glass or plastic, the coating of the invention is significantly different from that of the present invention and fails to teach use of layers of the soft metal oxides. To the extent that the '874 patent references the soft metal oxides as layers in a coating, it is in the context of criticizing the performance and durability of the resulting coatings. See Col. 2, Lines 54-57 and Col. 3, Lines 37-42. Further, the '874 reference to soft metal oxides is not in connection with a coating on plastic substrates. This is in contrast to a novel aspect of the present invention which is the unexpected discovery that certain anti-reflection coatings comprised of these soft metal oxides, when applied to plastic substrates, have performance characteristics comparable to anti-reflection coatings comprised of prior art hard metal oxides and that these soft metal oxides are more suitable for sputter deposition onto such plastic substrates. Accordingly, the '874 patent would not lead one of ordinary skill in the art to develop the claimed subject matter of the present invention. In fact, the '874 patent teaches away from the claims.

The '244 and '773 patents are related to different subject matter and do not teach the present invention as claimed here. The '244 and '733 patents are related to light attenuating coatings. Specifically, the '244 patents teach the use of alternating transition metal nitride layers which are substantially non-transparent. See column 7, lines 36-39 and column 14, lines 15-22. Thus, the coatings of these patents are not substantially transparent as required by all of the claims of the present reissue application.

Newly disclosed U.S. Patent Nos. 5,494,743 (the “‘743 patent”) and 4,799,745 (the “‘745 patent”) relate to anti-reflection coatings deposited on organic polymer (plastic) substrates, however, the layers are “discontinuous.” See the ‘743 patent at col. 9, lines 24-26. See also Figures 5-8. Further, the ‘743 patent does not teach a layer of silicon dioxide as required by the new and amended claims of the present reissue application. The ‘745 patent teaches no more than the ‘743 patent. Thus, the Applicant respectfully submits that these references are merely cumulative.

G. Specific Response to Examiner’s Rejections

(1) Section 102 Rejections

The Examiner has cited the Bjornard ‘244 patent as the primary reference and has rejected claims 1-4, 6, 8, 11-14, 16, 18, 23, 26, 28 and 30 under Section 102 as being anticipated by such reference. This reference is distinguished from the claims for several reasons. First, the ‘244 patent relates to a “light attenuating” anti-reflection layer. This means that it reduces the intensity of the light as it passes through the coating. This is consistent with the entire disclosure of the ‘244 patent which requires several of its layers to be comprised of “transition metal nitrides”. These layers are not clear or substantially transparent. In contrast, all claims of the present invention require the plurality of layers to be “substantially transparent to visible light”, thus resulting in a coating which is substantially transparent.

Secondly, although the substrate 28 in column 7, lines 58-60 of the ‘244 patent is identified as being either glass or plastic, the patent fails to disclose any specific combination of layers or materials for a plastic substrate. Further, it is significant that the ‘244 patent specifically

states (in column 4, line 24) that “in all the tables, the substrate is assumed to be glass”. This is presumably because the individual layers may perform differently depending upon whether they are applied to glass or plastic and depending upon the specific refractive index of the substrate. Further, it is mere speculation to conclude that the same combination of layers disclosed in the ‘244 patent with respect to a glass substrate would also provide satisfactory performance when applied to a plastic substrate. Thus, the ‘244 patent is a “teaching” reference only with respect to the specific disclosures on a glass substrate.

Thirdly, independent claims 1, 2, 33, 38, 39, 40, 43, 45 and 47 require at least two of the layers of the identified soft metal oxides, with independent claims 33, 38, and 39 further requiring at least two layers to be composed substantially of silicon dioxide. With the exception of Examples 10 and 11, the ‘244 patent fails to disclose two layers of tin dioxide (SnO_2). However, with respect to the example in Table 10, which includes the additional layer of SnO_2 , the ‘244 patent actually teaches that it is unnecessary. For example, see column 12, lines 33-37 which states that the addition of such layer “may not yield a significant improvement in anti-reflection performance or a significant difference in the attenuation of visible light.” The only example of the ‘244 patent which discloses two layers of silicon dioxide is Example 7; however, this example eliminates all layers of SnO_2 .

With respect to independent claim 45 and dependent claim 46, the soft metal oxide layer requires the lower refractive index material to be adjacent to the metal oxide layer. This is exactly the opposite of that which is disclosed in the ‘244 patent. In the ‘244 patent, the transition metal nitrides which are adjacent to the SnO_2 layer have a higher refractive index.

With respect to independent claim 46 and its dependent claim, the material of lower refractive index is required to be disposed between each of the plurality of oxide metal layers. This is not disclosed in the '244 patent. A similar distinction exists with respect to independent claim 47.

Accordingly, for all of the above reasons, it is believed that all claims in the present reissue application are distinguished from the '244 patent under Section 102(b) and reconsideration is respectfully requested.

(2) Section 103 Rejections

Claims 5, 15 and 27 (now canceled) were rejected as unpatentable under Section 103 over the '244 patent in view of the Austin '552 patent. The above claims differ from their respective independent claims in that they require the reactively sputtered material to be "tin-doped indium oxide". This rejection is traversed for the following reasons:

First, because of the amendments made to the independent claims from which these claims depend, the primary '244 reference no longer anticipates or meets all of the claimed limitations of the coating. Accordingly, these claims are considered patentable for the same reasons as their respective independent claims discussed above.

Secondly, although tin oxide and tin-doped indium oxide are both metal oxides or modified metal oxides, there is no teaching in Bjornard '244 or in Austin '552 that the tin-doped indium oxide layer of '552 could be substituted for the tin oxide layer in Bjornard '244. Despite the fact that their refractive indices may fall within the same general range, this is not sufficient for a person skilled in the art to conclude that the two materials would be exchangeable in a

reactive sputter coating environment for use in preparation of an anti-reflection coating. In view of the fact that this is an extremely crowded art, that small differences in material, thickness, indices of refraction, etc., can make significant differences in reflection or transmission capability, and the fact that there is no disclosure in the '244 patent that layer 26 could be a "conductive" layer such as tin-doped indium oxide, it is submitted that it would not have been obvious to combine these references in the manner suggested by the Examiner.

Dependent claims 7, 17 and 29 (now canceled) have been rejected under Section 103(a) as being unpatentable over the Bjornard '244 patent in view of the Dickey '874 patent. Claims 7 and 17 both specifically require, among other things, a four layer system in which the first and third layers are substantially silicon dioxide and the second and fourth layers are metal oxide layers. Because these claims, like claims 5 and 15, depend from independent claims which are believed to be patentable, claims 7 and 17 are considered to be patentable for the same reasons.

Further, the four layer system defined by claims 7 and 17 does not conform to the disclosure in the '244 patent. For example, in claims 7 and 17, both the second and fourth layers are required to be composed of the metal oxide layer. This is significantly different than the '244 patent in which every second and fourth layer in every one of the examples is disclosed to be titanium nitride or presumably one of the other transition metal nitrides. Also, the '874 patent to Dickey actually teaches away from the use of soft metal oxides. Instead, the disclosure and claims require niobium oxide. There is no suggestion or teaching in any reference that it would have been obvious to combine these teachings to result in a structure which would render the present claims unpatentable. This is particularly true in view of the fact that Bjornard '244 absolutely requires a transition metal nitride as its second and fourth layers. To deviate from this would be

inconsistent with the disclosure and thus not obvious. Similarly, with respect to the '874 patent, such patent specifically discloses against the use of soft metal oxides such as zinc oxide and teaches niobium oxide instead. Thus, the use of such a material other than niobium oxide as layers two and four of the '874 patent would be contrary to its teachings and thus not obvious.

Summary

For all of the above reasons, and particularly in view of the amendments to the claims, the discussion of the references cited by the Examiner, and the distinctions between the present claims and these references, it is believed that all of the claims in the application are now in condition for allowance and such action is respectfully requested.

Respectfully submitted,

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